SD Department of Environment & Natural Resources
Water Resources Assistance Program
Total Maximum Daily Load

Lake Faulkton Watershed, Faulk County South Dakota
February, 1999

These TMDLs were developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by the US Environmental Protection Agency. The 1998 303(d) Waterbody List identified Lake Faulkton as impaired by a measure of accumulated sediment and Trophic State Index (TSI) which serves as an indicator of the trophic condition of the lake. TMDLs for accumulated sediment and total phosphorus have been developed and are supported below.

TMDL Summary for Total Phosphorus

Waterbody Name	**Lake Faulkton**
Hydrologic Unit Code (HUC)	10160008
TMDL Pollutant	**Total phosphorus**
Water Quality Target	Inlake phosphorus TSI of 90
TMDL Goal	35% reduction in total phosphorus input
303(d) Listing Status	1998 303(d) Waterbody List, Priority 1, Pages 22, 29, 33
Targeted Beneficial Uses	Warmwater semipermanent fish life propagation; immersion recreation; limited contact recreation
Reference Document	Lake Assessment Project, Lake Faulkton, Faulk County, South Dakota (SDDENR, 1996)

TMDL Summary for Accumulated Sediment

Waterbody Name	**Lake Faulkton**
Hydrologic Unit Code (HUC)	10160008
TMDL Pollutant	**Accumulated Sediment**
Water Quality Target	Remove 150,000 cubic yards of sediment
TMDL Goal	Increase depth by 6 feet over 15.5 surface acres
303(d) Listing Status	1998 303(d) Waterbody List, Priority 1, Pages 22, 29,33
Targeted Beneficial Uses	Warmwater semipermanent fish life propagation; immersion recreation; limited contact recreation
Reference Document	Lake Assessment Project, Lake Faulkton, Faulk County, South Dakota (SDDENR, 1996)

I. Executive Summary:

- ***Waterbody Description and Impairments***

Lake Faulkton is a 115-acre reservoir on the South Fork of Snake Creek. The lake is located in Faulk County, South Dakota, which is in the north central part of the state. The community of Faulkton, South Dakota is located two miles east of Lake Faulkton.

The watershed area for Lake Faulkton is approximately 161,320 acres. The watershed area to lake area ratio is 1,403 to 1.

The Lake Faulkton Assessment Project was initiated in 1993 at the request of local citizens concerned about the deteriorating condition of the lake. The main concerns included encroachment of cattails and other aquatic plants, sporadic fish kills because of low oxygen conditions, and overall reduced recreational opportunities at the lake.

The purpose of the project was to assess the lake's general status, to determine factors that were inhibiting the lake's uses, and to develop specific alternatives for restoration of the lake.

The data collection phase of the study included gathering information on tributary and inlake water quality, an evaluation of the lakeshore, an aquatic plant survey, a sediment survey, and analysis of the lake watershed by use of the Agricultural Non-Point Source (AGNPS) computer runoff model. Analysis of the water quality samples was conducted by the State Health Laboratory in Pierre, South Dakota.

After the data was collected, it was submitted to the DENR Watershed Protection Program for evaluation. Outputs of the data evaluation included an assessment of the trophic status of the lake, computation of sediment and nutrient loadings to the lake, and identification of critical areas in the watershed.

The results of the Lake Faulkton Assessment Project indicated that significant loadings of sediment and nutrients are retained in the lake. A sediment survey of the lake determined that the total sediment volume is approximately 277,793 cubic yards. Measurements of the sediment depth varied from one foot in near-shore areas, to nearly seven feet in deeper water areas. Sources of the sediment include watershed runoff and shoreline erosion. The in-lake monitoring resulted in a mean trophic state index of 76.0, which classified the lake as hypereutrophic. Low inlake oxygen levels were observed, and a partial winterkill of fish occurred during the winter of 1993 – 1994. Extensive aquatic plant growth in the lake limits swimming, boating and fishing recreation.

- ***Stakeholder Description***

Faulk Conservation District
Lake Faulkton Association
Farm Service Agency, Faulk County
NRCS, Pierre
SD Department of Environment and Natural Resources
SD Department of Game, Fish & Parks

The Faulk Conservation District was the local sponsor of the Lake Faulkton Assessment Project. Lake Faulkton was listed as a priority of the Section 319 Nonpoint Source

Pollution Control Program for South Dakota. Funds for the project were obtained from a Section 604(b) grant and a Section 319 Development grant administered by the Environmental Protection Agency (EPA) and provided to the State of South Dakota.

The local match needed for the project was provided by the Faulk Conservation District and through in-kind services of local businesses and volunteers.

Following completion of the Lake Faulkton Assessment Project, a Lake Faulkton Restoration Project Committee was established. The Restoration Project Committee has provided information to the public about the results of the assessment project, and has generated support in the Faulkton community to pursue the implementation of a Lake Faulkton Restoration Project.

- ***Intent to Submit as a Clean Water Act Section 303(d) TMDL***

In accordance with Section 303(d) of the Clean Water Act, the South Dakota Department of Environment and Natural Resources submits for EPA Region VIII review and approval the total phosphorus and accumulated sediment total maximum daily loads (TMDLs) for Lake Faulkton as provided in this summary and attached document. These TMDLs have been established at a level necessary to meet the applicable water quality standards for nutrients and sediment with consideration of seasonality and a margin of safety. The following designated use classifications will be protected through implementation of this TMDL: immersion recreation, limited contact recreation and warmwater semi-permanent fish life propagation.

II. Problem Characterization:

- ***Waterbody Description/Maps***

Lake Faulkton is located on the South Fork of Snake Creek. Snake Creek is a tributary of the James River, which lies in the Missouri River Basin. A map of the Lake Faulkton watershed is attached as Figure 1. The maximum depth of the lake is 24 feet, and the average depth is 9.3 feet.

Lake Faulkton was formed by the construction of an earthen dam across the South Fork of Snake Creek. Construction of the dam began in 1932 as a County Work Project, and was completed in 1935, financed by the Works Progress Administration (WPA). From 1935 to 1936 the WPA constructed a concrete spillway using mainly horsepower and manpower. The stated purposes and objectives of the project were water conservation, recreation, and flood control.

A major maintenance project was undertaken in the summer of 1994. The South Dakota Department of Game, Fish and Parks contracted to have the spillway basin enlarged and then protected with a layer of field boulders. The sides of the gorge downstream of the spillway were re-contoured with heavy earth-moving equipment. The spillway face

was repaired by filling and caulking cracks. Approximately $160,000 was spent to lengthen the life of the Lake Faulkton dam.

- ***Waters Covered by TMDL***

Lake Faulkton is the benefactor of this TMDL.

- ***Rationale for Geographic Coverage***

The main tributary to Lake Faulkton is the South Fork of Snake Creek. The watershed area for Lake Faulkton lies primarily in Faulk County, with parts of the watershed also extending into Potter, Hyde, and Hand Counties. The total watershed is approximately 161,320 acres in size.

- ***Pollutants of Concern***

Total Phosphorus
Accumulated Sediment

- ***Use Impairments or Threats***

The mean Trophic State Index (TSI) values for Lake Faulkton during the assessment period were 96.5 (hypereutrophic) for phosphorus, 58.3 (eutrophic) for Secchi disk measurements, and 73.2 (hypereutrophic) for chlorophyll *a.* These values resulted in a mean TSI of 76.0 for the study period, which places Lake Faulkton in an over-all hypereutrophic classification.

The average in-lake total phosphorus during the assessment was 0.612 mg/L. Algae requires only 0.02 mg/L of dissolved phosphorus to start growing, so Lake Faulkton averages over 30 times the minimal requirements for algal growth. In spite of this over-abundance of phosphorus, algal blooms are not the primary water quality problem in Lake Faulkton at this time. Rather, extensive growth of submerged and emergent aquatic plants is the major factor that interferes with recreational use of the lake. It is believed that macrophytes in the lake absorb most of their phosphorus from the water column, and may be out-competing the algal species for bioavailable phosphorus.
Vegetative die-off and organic decay increases the potential for depleted oxygen levels to occur, especially during the winter months. This leads to the impairment of the warmwater fishery within the lake by excessive fish kills.

The water quality monitoring during the assessment demonstrated that Lake Faulkton acts as a sink for nitrogen and phosphorus. Nitrogen is generally not a limiting nutrient for some blue-green algae because they are capable of producing the nitrogen they need if it is not readily available in the environment. Algae and other plants, however, are not capable of generating the phosphorus nutrients they require. If phosphorus can be limited, there may be an opportunity to limit algae and aquatic plant growth. With Lake Faulkton acting as a phosphorus sink—more phosphorus coming in than going out—there is presently little opportunity to limit algae and aquatic plant growth. Any

attempt at limiting algae and aquatic plant growth will require a reduction in available sources of phosphorus, including tributary inflow phosphorus as well as internal phosphorus loading from the lake sediment.

Implementation of best management practices at the lake and in the watershed will lead to reductions in phosphorus levels. Reductions in phosphorus levels will in turn lead to a decline in the growth of algae and aquatic plants resulting in less organic decay leading to decline in the incidence of fish kills. These reductions will improve the recreational opportunities at the lake such as fishing, swimming, boating, and skiing, in addition to fish life propagation.

Accumulated sediment affects the beneficial uses of immersion recreation and limited contact recreation. The warmwater semipermanent fish life propagation beneficial use is not impacted by accumulated sediment in Lake Faulkton due to the maximum depth of 24 feet and the mean depth of 9.3 feet.

Loss of depth due to accumulated sediment exposes more bottom sediment to sunlight. This enhances the population of aquatic macrophytes. The over abundance of these macrophytes impair recreational use of the lake.

- ***Probable Sources***

An analysis of the lake watershed was conducted by use of the Agricultural Non-Point Source (AGNPS) computer runoff model. The AGNPS model subdivided the entire watershed into 40-acre cells, and predicted critical runoff cells based upon 21 data inputs per cell. The model indicated that due to the size of the watershed, the volume of nutrients being delivered to Lake Faulkton is high. The model predicted 57.8 tons of nitrogen and 15.8 tons of phosphorus are delivered to the lake per year. Based upon this analysis, it was recommended that conservation practices should be targeted to erosion and nutrient control measures concentrated in critical cells. It was further stated in the report that the most probable source of high nutrient yields found within the watershed is from the management and land use practices associated with animal feeding areas.

A total of 36 animal feeding areas were evaluated as part of the AGNPS analysis. Feedlot rankings were derived from the AGNPS version 5.00 model. It was recommended that animal feeding areas with a ranking greater than 55 should be targeted for treatment. Based on these criteria, it appeared that 15 animal feeding areas were contributing excessive nutrients to the watershed. It was recommended that the 15 animal feeding areas should be considered for treatment due to their AGNPS ranking and proximity to major streams and the lake.

The 36 animal feeding areas in the lake watershed were analyzed to determine the amount of nutrients they contribute to the lake. Based on this analysis, the 15 priority

feeding areas were found to contribute a total of 2.6 tons of phosphorus to Lake Faulkton per year. As stated above, the AGNPS model also predicted that a total of 15.8 tons of phosphorus are contributed to the lake during per year. Consequently, by treating and removing the phosphorus runoff from the 15 priority feeding areas, a 16% reduction of phosphorus loading to the lake would be accomplished.

The AGNPS model further analyzed the subwatersheds of the lake watershed to determine critical areas for sediment and nutrient runoff. Based on this analysis five subwatersheds (#1308, #2004, #2069, #2215, and #1452) were found to be contributing above normal phosphorus yields. The total acreage of these six subwatersheds is 85,960 acres. The AGNPS model calculated that the annual phosphorus delivery rate to Lake Faulkton is 0.22 pounds/acre per year. By applying best management practices to the five priority subwatersheds, a 19% reduction in total phosphorus may be achieved. By combining the 2.6 tons of phosphorus removed from the 15 priority feeding areas with the 2.9 tons of phosphorus reduced from field runoff, a total of 5.5 tons of phosphorus would be eliminated from Lake Faulkton. The 5.5 ton reduction in phosphorus would be a 35% reduction of the 15.8 tons of phosphorus predicted to flow into Lake Faulkton annually.

Sources of accumulated sediment in Lake Faulkton appear to be historical only. The results of tributary inflow monitoring indicate minimal sediment loads. The measured load of sediment into the lake during 1994 was 152 tons. The accumulated sediment in the reservoir has been estimated to be 277,793 cubic yards. The sediment volume of Lake Faulkton was determined by a field sediment survey conducted during the Lake Faulkton lake assessment project.

III. TMDL Endpoint:

- ***Description***

The TMDL goal was established based on the AGNPS model that predicted that a 35% reduction in phosphorus input from the watershed is possible by elimination of nutrients from the 15 priority animal feeding areas and by treating the five priority subwatersheds. Reducing inflow concentrations of phosphorus will result in a lower ambient total phosphorus concentration in Lake Faulkton. A lower phosphorus concentration in the lake will result in decreased biomass of macrophytes. This will improve average dissolved oxygen concentrations in the lake during the winter months. Therefore this will decrease the frequency of winterkill.

The accumulated sediment TMDL goal for Lake Faulkton is to increase the depth of the lake by six feet over 15.5 surface area acres. This will accomplished by the removal of 150,000 cubic yards of sediment. Removal of sediment will increase the depth and clarity of the lake, which will then improve the lake for fish life propagation and increase the recreational uses.

- ***Endpoint Link to Surface Water Quality Standards***

Total Phosphorus

The TMDL target is to reduce total phosphorus TSI to <90. The current mean total phosphorus TSI is 99, according to data collected as part of the Statewide Lakes Assessment.

Accumulated Sediment

The TMDL target is to remove 150,000 cubic yards of sediment which will allow the TMDL goal to increase the depth of the lake by six feet over 15.5 surface acres to be met.

IV. TMDL Analysis and Development:

- ***Data Sources***

Data was collected by SD DENR, the Faulk Conservation District, and Faulk County NRCS from the fall of 1993 to the summer of 1995.

- ***Analysis Techniques or Models***

Hydrologic and water quality data was obtained from six tributary monitoring station locations throughout the watershed as well as two inlake sites. Samples collected at each site were taken according to South Dakota's EPA approved Standard Operating Procedures for Field Samplers. Water samples were sent to the State Health Laboratory at Pierre for analysis. Quality Assurance/Quality Control samples were collected on 10% of the samples according to South Dakota's EPA approved Clean Lakes Quality Assurance/Quality Control Plan.

In addition to water quality monitoring, data was collected to complete the comprehensive AGNPS watershed land use model. The AGNPS model was developed by the United States Department of Agriculture (Young, et al., 1994) to provide comparative values for forty-acre cells in a watershed. The model prioritizes areas of the watershed for phosphorus reduction, and allows targeting the sources for load allocations.

- ***Seasonality***

Different seasons of the year can yield differences in water quality due to changes in precipitation and agricultural practices. To determine seasonal differences, tributary samples were reviewed as spring samples (March 14 - May 2, 1994 and February 22 - April 3, 1995); and summer samples (July 7 – August 29, 1994). No fall samples were collected as the tributaries stopped flowing in the fall of 1994, which was the only fall season during the watershed assessment project.

The volume of runoff in the spring of 1994 was close to normal. However, the summer of 1994 was quite dry. By the end of August all of the streams had stopped flowing, and there was no more flow during the fall. By comparison, the spring of 1995 was very wet, resulting in a large number of samples being collected in a short time.

In the Lake Faulkton Assessment Project Report, the total loadings during 1994 were compared to the total loadings during the spring runoff of 1995. It was found that because of the high volume of runoff during the spring of 1995, total loadings during that short period were comparable to the total loadings for all of 1994. From those results, it was determined that the volume of loadings during a wet spring runoff are much higher than the loadings that occur over typical summer months, and can be much greater than what occur during even a normal spring runoff.

- ***Margin of Safety***

To meet the TMDL goal of a 35% reduction in tributary phosphorus loadings the runoff from 15 priority animal feeding areas must be controlled and best management practices need to be installed on five priority subwatersheds.

Additional phosphorus reduction can be achieved by controlling the runoff from other animal feeding areas in the watershed. Another way that the additional reduction can be achieved is to target best management land practices to other areas in the watershed. Selective aquatic macrophyte harvesting is a technique that can be used to reduce the organic biomass in the lake resulting in increased phosphorus removal.

Another lake restoration practice recommended by the committee is dredging of Lake Faulkton. Although a dredging project would not help to reduce the inflow of sediment and nutrients from the watershed, it should ultimately help to reduce inlake nutrient levels by reducing the nutrients that leach from the lake sediment up into the water column.

Runoff from the public golf course located on the shore of Lake Faulkton contributes a significant load of highly available dissolved phosphorus to the lake during storm events. The 1995 study showed concentrations of dissolved phosphorus in golf course runoff ranged from a low of 0.490 mg/L to a maximum of 4.430 mg/L. Nutrient management practices could be developed for the course. Another option would be the construction of a runoff containment facility.

Post-implementation monitoring is recommended to observe if the implemented controls are indeed meeting the target. In addition to mid-course and post-implementation monitoring, Lake Faulkton will be routinely sampled every two to four years as part of the South Dakota Statewide Lakes Assessment Program. The combination of these various monitoring activities will indicate if the TMDL is achievable or if other controls will be needed.

V. Allocation of TMDL Loads or Responsibilities:

- ***Waste Load Allocation***

There are no point sources of pollutants of concern in this watershed. Therefore, the "wasteload allocation" component of these TMDLs is considered a zero value. The TMDLs are considered wholly included in the "load allocation" component.

- ***Load Allocation***

The recommended target for improving the water quality of Lake Faulkton is to reduce total inlake phosphorus concentrations by 35%. This can be accomplished by reducing the average tributary phosphorus loading to the lake by 35%. According to the AGNPS model, controlling runoff from 15 priority animal feeding areas with AGNPS rankings greater than 55 will result in a 16% reduction in phosphorus. By treating the five priority subwatersheds, another 19% reduction of phosphorus will be achieved which will bring the total reduction of phosphorus to 35%. The control of runoff from any additional animal feeding area(s), the control of runoff from the golf course, or the treatment of additional critical cells in the watershed, should ensure that the goal of a 35% reduction of the phosphorus loading to Lake Faulkton will be achieved. It is recommended that these additional best management practices be implemented to minimize phosphorus loadings to the lake and surpass the TMDL goal.

- ***Allocation of Responsibility***

According to the water quality data and the AGNPS model, animal feeding areas are the most likely source of nutrients to Lake Faulkton. By use of the AGNPS model, monitoring, reduction response calculations, and best professional judgement, it is determined that the controls proposed below will achieve the TMDL goal of a 35% reduction in phosphorus loads to Lake Faulkton.

It is recommended that the 15 feeding areas with AGNPS ratings greater than 55 have animal waste systems constructed to eliminate nutrient and sediment runoff. Additional feeding areas should be evaluated for the implementation of runoff control systems.

Best Management Practices should be applied to the five priority subwatersheds as determined by the AGNPS model. Best Management Practices should also be applied to other priority areas in the watershed as recommended by the Lake Faulkton Restoration Project Committee.

A lake dredging project should be implemented to ensure accumulated sediment is removed.

VI. Schedule of Implementation:

The DENR is working with the Lake Faulkton Restoration Project Committee and the Northeast Council of Governments, Aberdeen SD, to initiate an implementation project beginning in the spring of 2000. It is expected that a local sponsor will request project assistance during the fall 1999 EPA Section 319 funding round.

VII. Post-Implementation Monitoring:

Once the implementation project is completed, post-implementation monitoring will be required to assure that the TMDL has been reached and improvements to the beneficial uses occur.

VIII. Public Participation:

- *Summary of Public Review*

The water quality assessment project was initiated during the fall of 1993 with EPA Section 604(b) funds. The project was later supplemented with EPA Section 319 Development funds. Lake Faulkton was on the priority list of Section 319 Nonpoint Pollution Control projects. The Faulk Conservation District agreed to sponsor the project and provided local matching funds and in-kind services. The federal grant funds totaled $17,706.00, and the local in-kind match totaled $7,379.48. Funds were used for water quality analyses, equipment, supplies, travel, and wages for the local coordinator.

- *Project Information and Education Efforts*

The following information summarizes efforts taken to gain public education, review, and comment during development of the TMDL. Public comments were received during an assessment project meeting, and at regular meetings of the Lake Faulkton Restoration Project Committee. The findings from these public meetings and comments have been taken into consideration in development of the Lake Faulkton TMDL.

Public Meetings/Personal Contact	*Articles/Fact Sheets*	*Document Distribution*
Pre-Project Meetings 1992 & 1993 **Mid-Project Meeting** April 6, 1995 **Post-Project Meeting** July 10, 1997 **Faulk Conserv. Brd. Mtg.** June 10, 1997 **Faulkton Town Council** November 3, 1997 **Faulk Co. Commissioners** November 4, 1997 **Faulkton Tuesday Club** November 4, 1997 **Oddfellows** November 4, 1997 **Faulktoneers** November 4, 1997	**Faulkton Record** June 12, 1996 July 2, 1997 July 9, 1997 July 16, 1997 July 23, 1997 August 13, 1997 February 25, 1998 May 6, 1998 May 20, 1998	**January, 1997** Faulk Conservation District Faulkton Library NRCS SD DENR SD GFP USGS

Cemetery Board November 5, 1997 **Lions Club** November 6, 1997 **Firemen** November 10, 1997 **Star (Masons)** November 10, 1997 **VFW & Auxiliary** November 12,1997 **Arts Council** November 13, 1997 **Rebekah Lodge** November 17, 1997 **Hospital Auxiliary** November 20, 1997 **Faulkton Businessmen** November 24, 1997 **Farm & Home Show** February 27, 1998 **Faulkton High School** March 10, 1998 March, 1999 Nov., 1997-Jan., 1998: **Am. Legion & Auxiliary** **Masons** **Golf Club** **Knights of Columbus** **Lake Cabin Owners** **Tamworth Township** **Irving Township** **Saratoga Township** **Lake Faulkton Comm. Mtg** January 19, 1998 February 23, 1998 April 27, 1998 June 22, 1998 July 20, 1998 August 10, 1998 September 21, 1998 November 16, 1998 November 30, 1998		

December 8, 1998 December 15, 1998 February 8, 1999		
Electronic Media	***Mailings***	***Public Comments Received***
December 1998 Assessment Summary added to department website **February, 1999** TMDL Summary advertised on department website	**Interested parties** March 10, 1999 **Stakeholders** March 10, 1999 **Daily Newspapers** March 8, 1999	Comments received during project meetings and review of the draft report and findings were considered.

IX. Supporting Development Document (attached):

Madison, K. R. and Fuerstenau, D., December, 1996. LAKE ASSESSMENT PROJECT, LAKE FAULKTON, FAULK COUNTY, SOUTH DAKOTA. Watershed Protection Program, Division of Financial and Technical Assistance, South Dakota Department of Environment and Natural Resources, Pierre, South Dakota.